Ann. Natal Mus. Vol. 21(3) Pages 533–556 Pietermaritzburg September 1973

A new genus of the Xestomyza-group from the western coast of South Africa, based on two new species with flightless females (Diptera: Therevidae)

by

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SYNOPSIS

Lyneborgia gen. nov. and its included species, *ammodyta* sp. nov. and *stenoptera* sp. nov., are diagnosed with respect to egg, first and last instar larva, pupa, and adult. Adults of both species are described. Certain features of the genus are discussed: flightlessness, phallus asymmetry, oviposition, and hatching sequence. Larval cephalic terminology is revised. The relationships of *Lyneborgia* to the other genera of the *Xestomyza*-group, and especially *Henicomyia* Coq. of the New World, are discussed. A sister-group relationship between *Lyneborgia* and *Henicomyia* is postulated.

INTRODUCTION

Since the publication of Lyneborg's monograph on the *Xestomyza*-group of Therevidae (1972) and my contribution to knowledge of the habitats and immature stages of those flies (Irwin 1972), I have had an opportunity to collect along the western coast of the Cape Province. While there, my wife and I gathered several specimens of immature Therevidae, some of which, after having been brought into the laboratory, pupated and eventually transformed into adults of a spectacular *Xestomyza*-group genus new to science. This new genus, *Lyneborgia*, is herein described, and named in honor of Dr Leif Lyneborg, University Zoological Museum, Copenhagen, who has done more than anyone else to correct and define the internal taxonomic hierarchy of the Therevidae in general and of the *Xestomyza*-group in particular.

Lyneborgia is spectacular because of two interesting, apomorphous features, namely, flightlessness in the female and a twisted, asymmetrical phallus in the male.

Procedures for gathering and rearing specimens were the same as those employed by Irwin (1972, and *in press*). However, dates of pupation and eclosion were not noted. Preparation of material was similar to that described by Lyneborg (1972) and Irwin (1972). Male terminalia were dissected out, positioned in the desired view in glycerine gel on cavity slides, and drawn after the gel had set. Their natural curves and shapes were therefore reproduced. However, sclerites of abdominal segment 8 (sternite 8 + tergite 8) were flattened between microscope slide and cover slip before being drawn. The natural curves of these sclerites were exceedingly great and their shapes were more easily comparable when flattened. Table 1 is fashioned after Lyneborg (1972).

Each specimen was assigned a unique number to facilitate the association of data. This number appears below the specimen on a yellow label bearing the following words in small offset print: THEREVIDAE/M. E. Irwin/Specimen#. Numbers referring to specimens will be found throughout the text and figures in **bold face type**. These numbers will eventu-

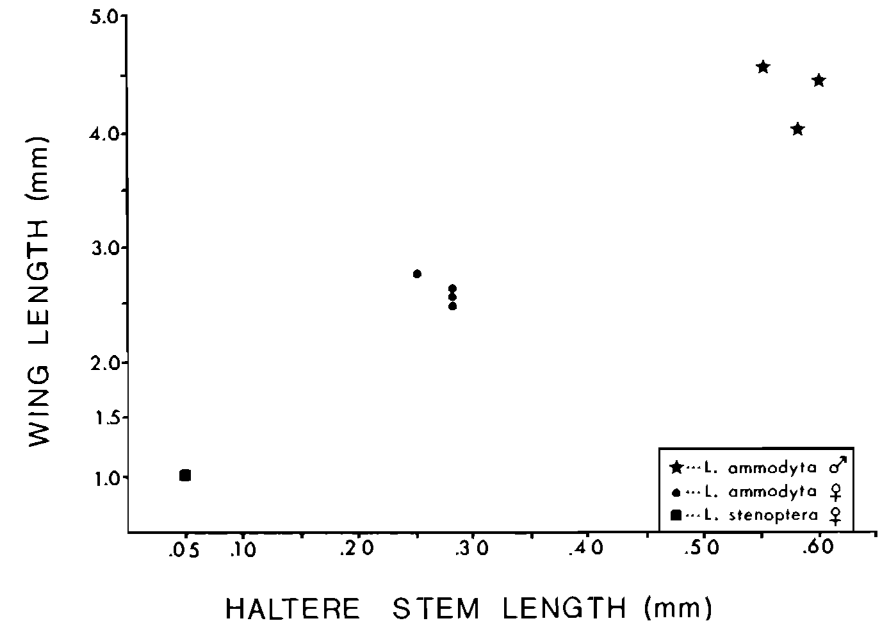
ally be used to incorporate the specimens into an overall automated data management system (Rauch 1970; Irwin, *in press*).

All linear measurements in figures and table are in millimetres.

SPECIAL FEATURES OF *LYNEBORGIA*

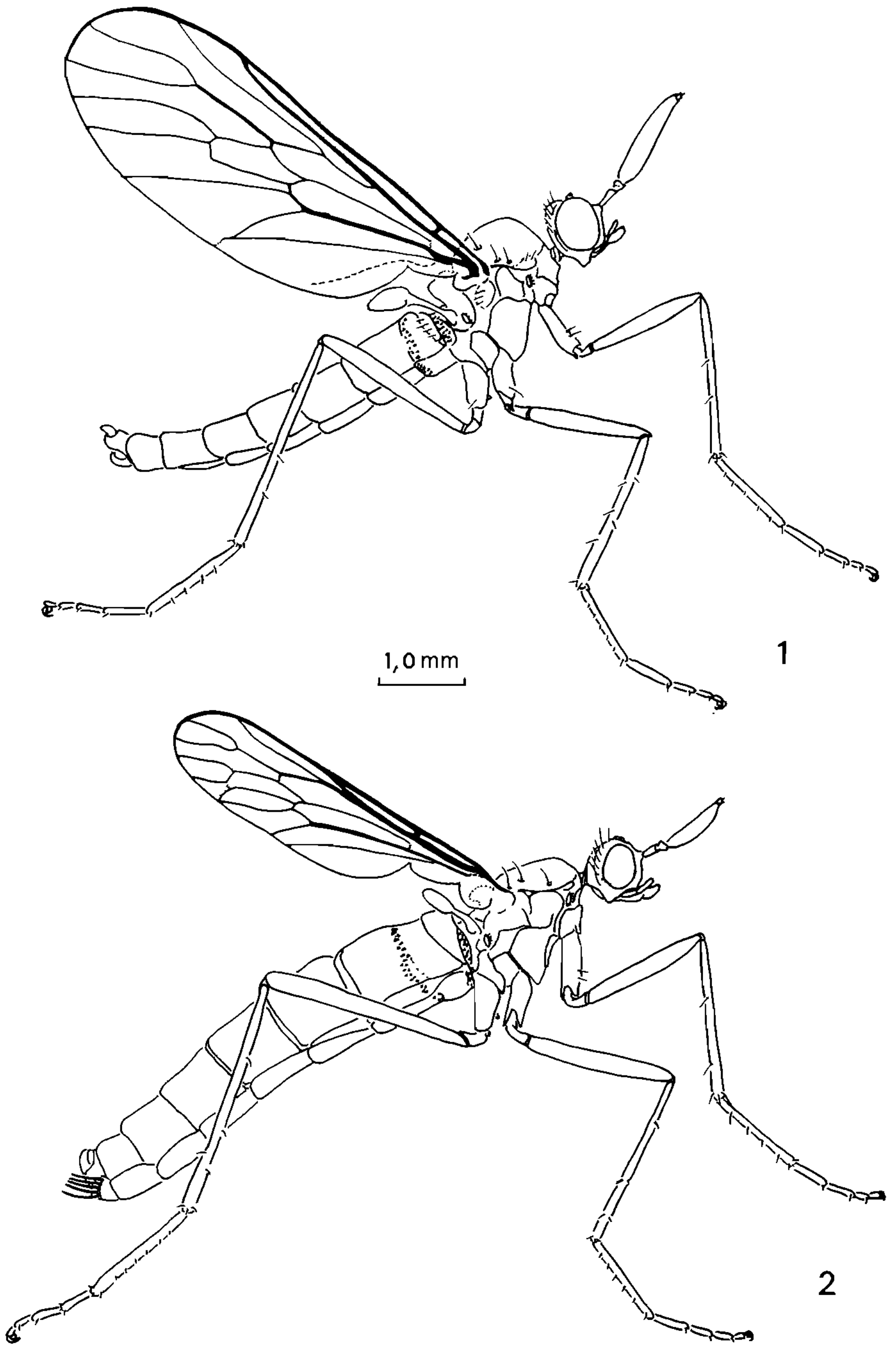
Lyneborgia is based on two new species, *L. ammodyta* (type species) and *L. stenoptera*, in both of which the females are flightless. To my knowledge, this is the first reported case of flightlessness among the Therevidae. The wings of female *L. ammodyta* are short (figs 2, 14) and would be classified as 'brachypterous' according to Hackman's (1964) definition. Those of female *L. stenoptera* fit, though awkwardly, into his category of 'stenopterous'. Although not extremely narrow, the wing is very reduced and the radial vein is distinguishable (figs 3, 15), especially the radial sector. Veins beyond the radial sector are indistinct except for some faint impressions.

The concurrent reduction of wing and haltere size is notable in *Lyneborgia.* Haltere size reduction was found to be largely the result of haltere stem reduction. The correlation between wing length (measured from humeral cross-vein to tip of wing) and haltere stem length was striking (significant at the 0,001 level by Pearson's 'r' test), as the graph given below depicts.



A denser macrotrichial covering was evident on specimens with smaller wings (figs 13, 14, 15), indicating that little or no reduction in the number of macrotrichia accompanied wing reduction.

The phallus of male *L. ammodyta* (males of *L. stenoptera* were not available) is twisted



Figs 1–2. *Lyneborgia ammodyta* gen. et sp. nov., lateral view. (1) Male (3934). (2) Female (3933).

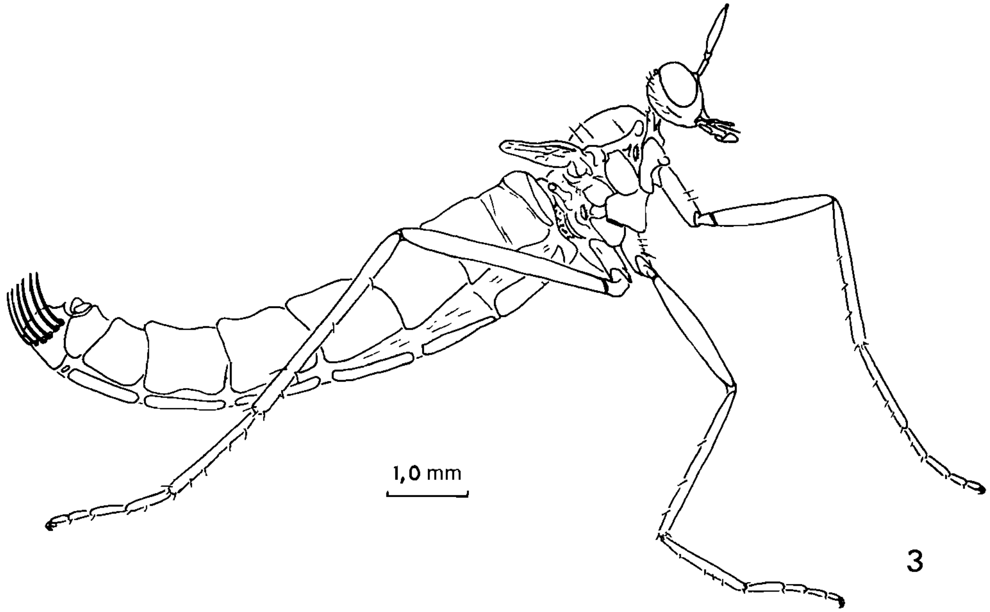


Fig. 3. *Lyneborgia stenoptera* gen. et sp. nov., lateral view, female (**3932**).

and exceedingly asymmetrical. Nowhere else in the *Xestomyza*-group, indeed, to my knowledge, nowhere else in the Therevidae, is this the case. The phallus of *Lyneborgia* contains a stout rod along its right-hand side extending from dorsocentral to posteroventral, which supports the curved phallic tip (figs 25, 26, 27). No corresponding asymmetrical structure was evident in the female terminalia (fig. 31).

Lyneborg reported (1972: 304, 306) that, 'The structure of the female terminalia forms one of the most obviously apomorphous characters of the *Xestomyza*-group. . . . The posterior margin of sternite 8 with its more or less strongly specialized pile certainly plays an important role during oviposition. This has, however, never been observed so far.' I have recently witnessed oviposition by *L. ammodyta* under laboratory conditions. Details of the oviposition sequence are reported below.

Spines or stout setae seem to play a major role in oviposition throughout the Therevidae. Most Therevidae, including the Therevinae, possess relatively stout spines on acanthophorites (tergite 9 of Hardy 1935 and Crampton 1942; tergite 10 of Lyneborg 1972). These apparently act as anchors, assisting the abdomen to become embedded by certain abdominal muscular contractions. Females of the *Xestomyza*-group have instead modified setae on abdominal sternite 8 which, during the rear-and-jerk phase of the ovipositional sequence, assist the insertion of the abdomen into the substrate.

The pherocerine sector of the *Rueppellia*-group lacks adaptive spines on the female terminalia. Instead, the hind legs, by digging a pit, assist the abdomen to penetrate deeply into the substrate (Irwin, *in press*).

It can be emphasized that the specialized structure of sternite 8 of females of the *Xestomyza*-group represents a functional apomorphous character.

Genus **Lyneborgia** gen. nov.

Derivation of name: Named in honor of Dr Leif Lyneborg.
Gender: Feminine.
Type-species: L. ammodyta sp. nov., by present designation.

Diagnosis

Adult. Adults of the genus *Lyneborgia* can be separated from all other genera of the *Xestomyza*-group by the following combination of characters: female flightless, either brachypterous or stenopterous; style on antennal segment III consisting of a basal section and a terminal bristle recessed into the basal section (fig. 10); scutellar setae absent; almost always with only one pair of notopleural setae; male with asymmetrically twisted phallus (figs 25, 26, 27); gonocoxite of male terminalia closed on inside by a bridge proximal to stylus (fig. 22).

Egg. Egg bluntly ovate, large (fig. 32), averaging 0,82 mm in length and 0,40 mm in width. No apparent reticulation or sculpture pattern discernible. The single female which oviposited in captivity (**3936**) laid 27 eggs.

Larva, last instar (figs 36, 37). Unpublished notes kindly provided by Dr Lyneborg have permitted me to update terminology of larval head structures employed in my previous paper (Irwin 1972). These corrections are given below.

Current terminology	*Prior terminology*
(1) Mandibular setae a, b, c	(1) Cephalic setae a, b, c
(2) basal segment and distal segment of mandible	(2) mandible
(3) Labial palps	(3) prementum
(4) postmentum	(4) ventral plate
(5) prementum	(5) unnamed area anterior to labial palps
(6) basal portion of maxilla with appendage	(6) labial palp
(7) lacinia	(7) anterior maxillary palps and beard of maxilla

Last instar larvae of *Lyneborgia* are very similar to those of other *Xestomyza*-group larvae. They can be separated from those of the other known *Xestomyza*-group genera, *Pentheria* Lyneborg and *Microgephyra* Lyneborg, by the following combination of characters: anterior pair of stout setae on fused labial palps (lb.p) reaching only to basal portion of globular, thick-spined appendage of maxilla; sensory cells positioned over dorsum of cephalic capsule in a definite pattern; mandibular setal lengths of 'a', 'b', 'c' in a ratio of about 7:3:1, 'a' always longer than 'b', 'b' longer than 'c'.

Larva, first instar. First instar larva similar in most respects to last instar larva with the following differences: most linear measurements about $\frac{1}{3}$ as long; mandibular setae 'b' and 'c' subequal in length; postmental sclerite poorly defined; labial palp lacking strong spines; arms of tentorium relatively narrower, width of tentorial arms of last instar about 3,3 times that of first instar, while length of tentorial arms of last instar about 2,3 times that of first instar; tip of lacinia with extra tooth-like appendage positioned between and anterior to the two palp-like appendages.

Figs 4–5. Habitats. (4) Coastal dunes near Papendorp at mouth of the Olifants River, Western Cape, 10 m alt. Larvae of *L. ammodyta* gen. et sp. nov. were sieved from under shrubs. (5) Inland sandy area, 17 km N.N.E. of Hondeklipbaai, Western Cape, 60 m alt. A single pupa of *L. stenoptera* gen. et sp. nov. was sieved from under large shrub in the centre of the photograph.

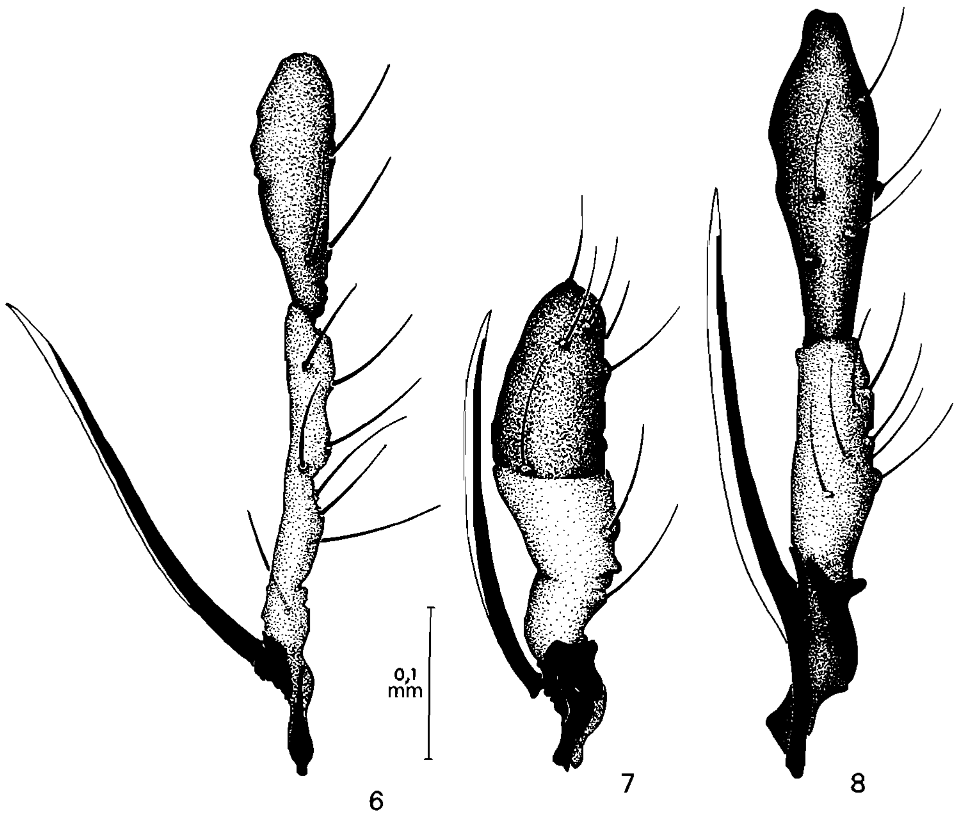
Pupa (figs 38–48). Pupae of *Lyneborgia* possess most of the characteristics of other *Xestomyza*-group pupae. Females can be easily separated by the smaller wing sheaths, and hence a more elongate appearance. Otherwise, dorsal spines of abdominal segments not strong and fused, those of *ammodyta* slightly stouter than those of *stenoptera*. Ratio of distance between outer margin of tubular sense organ of antennal sheath and apex of

antennal sheath (w) to outer margin of head capsule and apex of antennal sheath (z) less than 0,25:1 (fig. 42) (0,09:1 for *ammodyta* ♂, 0,13:1 for *ammodyta* ♀, 0,22:1 for *stenoptera* ♀). Labial sheath (figs 38, 39, las) elongate, reaching well beyond tips of proboscial sheath (prs). Labial sheath of *ammodyta* lobe-like (fig. 39), that of *stenoptera* wedge-like (fig. 38). Caudal spines of *Lyneborgia* pupae variable, those of *ammodyta* pinch together at apex (fig. 48), while those of *stenoptera* flare outwards at apex (fig. 47).

Description of adult

Length, excluding antennae, from 5,1 to 9,3 mm. Pile and tomentum relatively sparse. Ground colour ranging from a light yellow-tan to very dark brown.

Head. Broader than high and slightly higher than deep. Mean head width, height and depth greater in males than females (at least of *L. ammodyta*) and greater in *L. stenoptera* female than in *L. ammodyta* females, although ratios are constant between sexes and species. Eyes well-separated in both sexes. Frontal protuberance slight but distinct. Antennal insertion high, about 60% of the linear distance from lower edge of genae to ocellar



Figs 6–8. Palps of *Lyneborgia* gen. nov., lateral view. (6) *L. ammodyta* sp. nov. ♂ (3937). (7) *L. ammodyta* sp. nov. ♀ (3939). (8) *L. stenoptera* sp. nov. ♀ (3932).

tubercle. Antennae projecting away from head and upwards. Eyes large, covering most of head in profile views. Frons bare; face with a few weak hairs laterad of antennal sockets, otherwise bare. Ratios of antennal segments I/II/III about 3/1/11, male *L. ammodyta*; 2/1/6, female *L. ammodyta*; and 2/1/7, female *L. stenoptera*. Antennal segment III at least twice as long as segments I and II combined (except for specimen **3939** (female *L. ammodyta*) in which case segment III is not quite as long as twice I plus II). Style on segment III very similar to that of *Henicomyia*, consisting of a basal section and a terminal bristle recessed into the basal section (fig. 10); terminal bristle not often visible without the aid of a compound microscope. Segment I slender, with short, scattered pile; segment II globular, with a medial ring of short pile. Segment III much wider than either segment I or segment II and without pile. Proboscis slightly longer than palps; palpal segments of various shapes (figs 6, 7, 8). Segmentation of palps appears more obvious when viewed under low magnifications. Under high magnifications, actual segmental break difficult to detect.

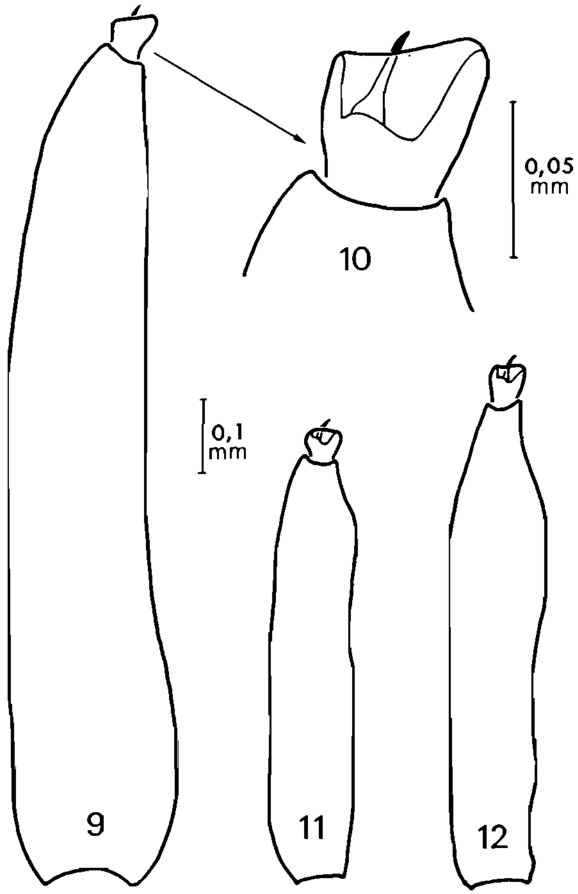
Thorax. Pile on mesonotum short, though slightly longer in males, and not very dense. Pile absent on scutellum and pleura except for a few hairs on the pleurotergite. Tomentum dense, golden, on mesonotum and scutellum, absent on upper pleura, dense, white on lower pleura. Setae as in *Henicomyia hubbardii* Coq., with one pair of notopleural (except two on one side of the male holotype of *L. ammodyta*), one pair of supra-alar, and one pair of postalar; scutellar and dorso-central setae absent.

Wings. Very large and wide in male; reduced in female. Radial sector and R_1 lack spines dorsally, but retain reduced sense organs in setal sockets (figs 16, 17, 18). Male: area surrounding apex of R_1 darkened; veins within narrow darker band, otherwise wings hyaline (fig. 13). Female *L. ammodyta*: generally dark due to concentration of macrotrichia; broad, dark band extending from apex of R_{2+3} to region apical of 1st M_2 cell (= discal cell); area at apex of M cell (= second basal cell) clouded (fig. 14). Female *L. stenoptera*: very darkened, especially apical $\frac{2}{3}$ (fig. 15).

Legs. Long, slender, short-haired. Femora without setae; t 1 with 0–3 pv setae only; t 2 generally with 2 av, 0–2 ad, 0–1 pd, 0–2 pv setae; t 3 with 2–4 av, 0–2 pd, 0–3 pv setae (ad usually absent). On the average, males possess more tibial setae than do females, and females of *L. ammodyta* possess fewer setae on t 1 and t 3 than does single female *L. stenoptera*.

Abdomen. Slender in male; very large, robust in female. Pile sparse, densest on dorsal portion of tergites and ventral portion of sternites, shorter anteriorly, longer posteriorly. Tomentum very sparse.

Male terminalia. Gonocoxite outwardly simple (fig. 21), inwardly complex (fig. 22); posterior margin simple, truncate; pilose area on lateral portions bulged out and more heavily sclerotized. Stylus inserted in front of posterior section of bulged portion (fig. 22), articulating on the inward side of the gonocoxite in two places: the basal portion of the bridge and a projection to the outward side of the stylus (figs 20, 22). Gonocoxite closed on the inside, i.e. there is a sclerotized bridge proximal to the stylus which separates it from the main cavity of the gonocoxite. Stylus simple, elongate, with downward projecting long setae and scattered short setae (fig. 21). Aedeagus compact with ventral apodeme extending into abdomen as two slender struts (fig. 27). Posteriorly, these struts join and their continuation articulates with the anteroventral portion of the phallus (fig. 25). Dorsad of the



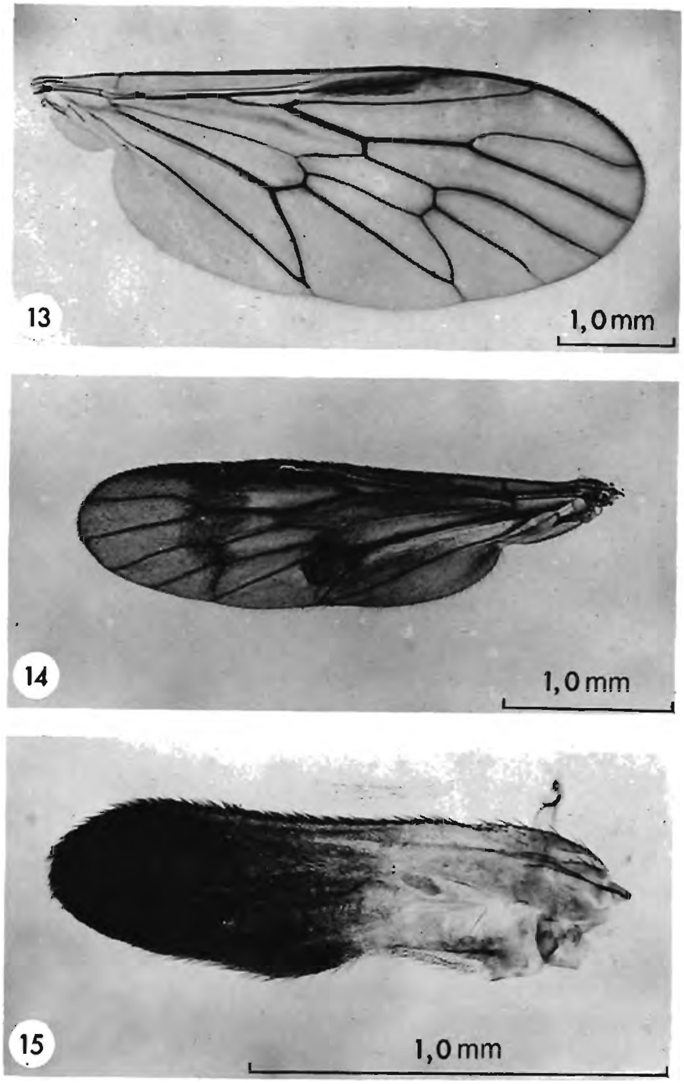
Figs 9–12. Third antennal segments of *Lyneborgia* gen. nov., lateral view. (9) *L. ammodyta* sp. nov. ♂ (3937). (10) *L. ammodyta* sp. nov. ♂ (3937), enlargement of style. (11) *L. ammodyta* sp. nov. ♀ (3939). (12) *L. stenoptera* sp. nov. ♀(3932).

ventral apodeme is the ejaculatory apodeme (fig. 25 e.a.) which is asymmetrically twisted. A short remnant of the dorsal apodeme is apparent on the anterodorsal surface of the phallus (fig. 25 d.a.). This apodeme connects the aedeagus to the gonocoxite along the bridge of the gonocoxite proximal to the stylus (figs 20, 22). Phallus complex, asymmetrically twisted and with a supporting rod on the right side attached from the apical part of the phallus to the ventral portion of the central section of the phallus (figs 20, 25, 26, 27). Epandrium simple, rather evenly setose (fig. 23), its apical lobes extending beyond level of cerci and paraproct (figs 19, 23). Hypandrium large, simple (fig. 24). Cerci simple, with short setae apically (fig. 23). Paraproct simple, with somewhat elongated setae apically (fig. 30). Tergite eight (fig. 28) and sternite eight (fig. 29) typical for *Xestomyza*-group.

Female terminalia. These are typical of the *Xestomyza*-group (fig. 31). For further details *see* Lyneborg (1972: 304 and figs 1–9).

Remarks

Lyneborgia has many of the attributes which characterize *Henicomyia* Coq. of the New World; among them, the following are noteworthy: thoracic and leg setation reduced, antennal style reduced and specialized, and antennal segment III (only with *Henicomyia*



Figs 13–15. Wings of *Lyneborgia* gen. nov. (13) *L. ammodyta* sp. nov. ♂ (3927). (14) *L. ammodyta* sp. nov. ♀ (3936). (15) *L. stenoptera* sp. nov. ♀ (3932).

hubbardii Coq.) sexually dimorphic. Furthermore, members of the two genera are somewhat similar in overall appearance.

The question put by Lyneborg (1972: 363), as to whether or not *Henicomyia* represents a sister-group to the African genera of the *Xestomyza*-group as a whole, can be more fully explored in light of the discovery of *Lyneborgia*. Lyneborg stated that 'Poor representation of thoracic setae (in *Henicomyia*) certainly is something original in comparison with the more well-developed setae in the African genera'. This no longer holds since *Lyneborgia* and *Henicomyia* possess exactly the same thoracic setal patterns. It is my belief that the reduction of thoracic setae is the apomorphous condition, not vice versa as was stated by Lyneborg.

Furthermore, all known African genera of the *Xestomyza*-group, with the exception of *Lyneborgia*, possess a two-segmented antennal style, and all of those that I have personally examined had the terminal bristle attached to the apex of the last style segment. *Henicomyia* and *Lyneborgia* have a single-segmented style with a terminal bristle recessed into the cavity at the apex of the style segment (fig. 10). I consider both the reduction in the number of the style segments and specialized recession of the terminal bristle to be apomorphous character states. Both *Henicomyia* and *Lyneborgia* possess somewhat reduced dorsal apodemes on the phallic portion of the aedeagus, but most African genera of the *Xestomyza*-group possess even more reduced dorsal apodemes. I consider the reduction and loss of the dorsal apodeme as the apomorphous character state.

Henicomyia, however, differs sharply from all African genera of the *Xestomyza*-group in that the radial sector and R_1 are setose dorsally. All genera, including *Henicomyia*, of the *Xestomyza*-group (as well as a randomly-chosen specimen of the other subfamily, *Thereva spiloptera* Wied.) possess reduced sensory setae and setal sockets on the radial sector and R_1 (figs 16, 17, 18), albeit of various modifications. *Henicomyia* alone among these genera has a setose R_1 which is probably a convergent apomorphous character. Since *Henicomyia* and *Lyneborgia* share so many apomorphous state characters, these two genera are most likely sister-groups and together form a sister-group with some section of the African genera of the *Xestomyza*-group.

Lyneborgia ammodyta sp. nov.

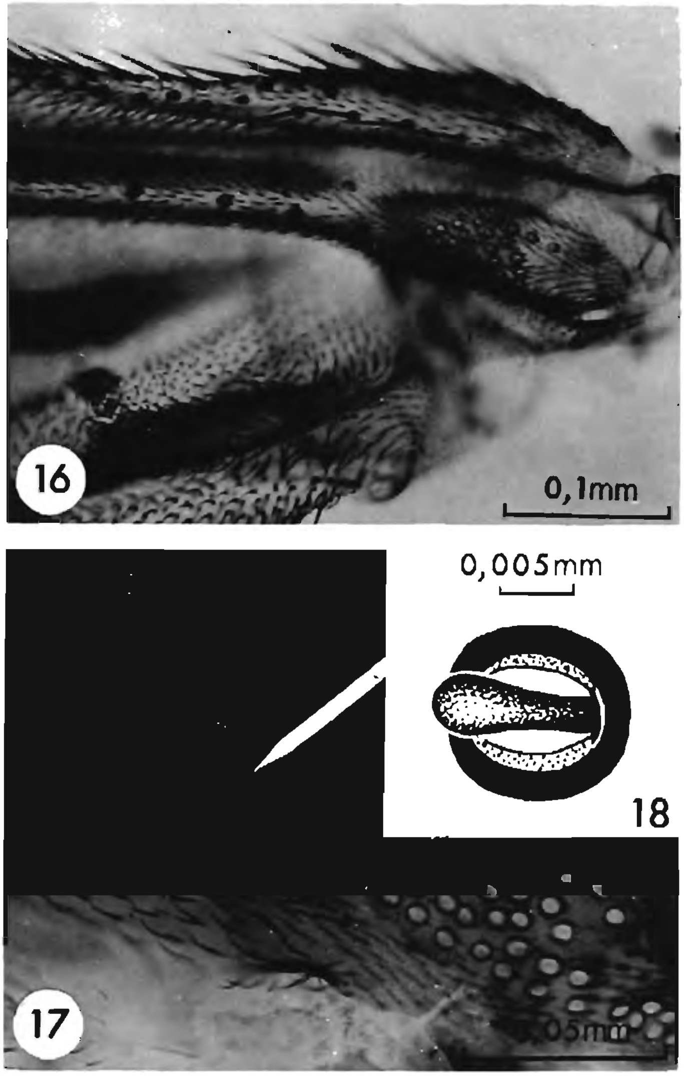
Derivation of name: ἄμμοζ = sand; δύτηζ = enterer.

Diagnosis: Since only the female of the other species in the genus is at hand, I shall attempt to diagnose only the female. Females of this species can be separated from those of *L. stenoptera* by the following combination of characters: body length less than 7,0 mm; wings brachpterous, longer than 2,5 mm from apex to humeral cross-vein; haltere length greater than 0,6 mm; leg coloration variable, but almost always with some yellow basally. Sternite 8 with stout, but shorter spines directed more outwards than upwards (fig. 2 vs. 3). *See* generic diagnosis for pupal differences.

Description

Male, holotype (fig. 1). *See* **3934** for numerical characters and measurements in table 1.

Length, excluding antennae, 5,50 mm. Ground coloration of body brown, of legs yellowish-brown. Pile sparse, long, golden on head and body; stout, darker on legs. Tomen-



Figs 16–18. Wings of *Lyneborgia* gen. nov. (16) *L. ammodyta* sp. nov. ♀ (3936) showing setal sockets on radial sector. (17) *L. stenoptera* sp. nov. ♀ (3932) showing setae and setal sockets on radial sector. (18) *L. stenoptera* sp. nov. ♀ (3932) enlarged sketch of seta and socket.

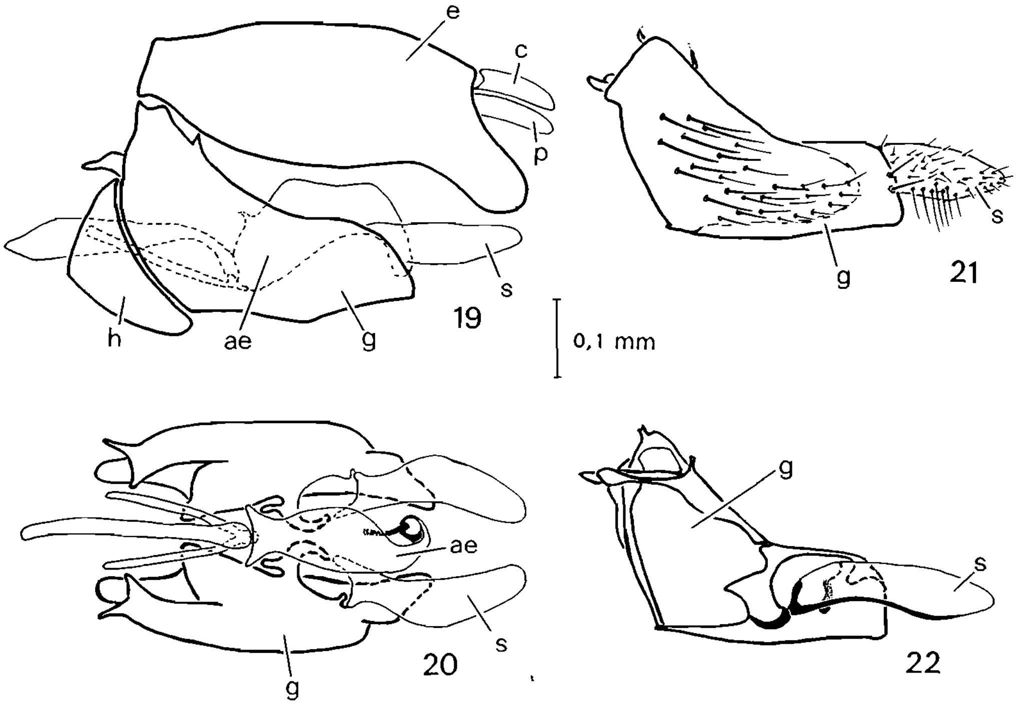
tum sparse to dense, golden, most dense dorsally; sparse, whitish on lower pleura; absent on legs and ventral surface of abdomen.

Head. Ground coloration dark brown. Pile on frons, face, genae reduced to six or seven pale golden hairs laterad of antennal sockets. About five pairs of thin, blond hairs on ocellar tubercle, occipital setae stout, black, scattered, about 16 pairs. Tomentum very

sparse on occiput, dense on frons and face, sparse on genae, and very sparse in oral cavity. Length of antennal segments I/II/III, 0,25/0,10/0,98 mm; segments I/II dark brown, III lighter brown. Antennal segment I elongate cylindrical, pile short, thin and evenly covering segment, tomentum sparse; antennal segment II bulbous, pile short, thin, in a continuous central ring, tomentum sparse; antennal segment III elongate, blade-like, devoid of pile (similar to figs 9, 10), tomentum dense. Proboscis slightly longer than palps; palps thinly setose (fig. 6), elongate with apical segments dark brown, basal segment light brown; apical segments about $\frac{3}{4}$ as long and twice as wide as basal segment.

Thorax. Ground coloration dark brown; mesonotum and scutellum appear light brown because of dense golden tomentum and short golden pile (pile absent on scutellum). Anepisternum shining dark brown, bare; pleurotergite with a central, vertical column of four pale, very fine, long hairs; sternopleurite, meropleurite, episternum and epimeron with dense white tomentum, pile lacking. Right side of mesonotum with two notopleural setae, left side with one.

Wing (similar to fig. 13). Ground coloration hyaline with light brown areas surrounding all veins. Faint brown patch stretching the length of the second radial cell; darker brown blotch surrounding vein R_1 near its apex. Vein M_3 entirely missing on both wings. Haltere knob and stem yellow.



Figs 19–22. Male terminalia of *Lyneborgia ammodyta* gen. et sp. nov. (3934). (19) Terminalia in lateral view. (20) Terminalia in dorsal view, epandrium removed. (21) Left gonocoxite, outside lateral view. (22) Right genocoxite, inside lateral view. ae = aedeagus, c = cercus, e = epandrium, g = gonocoxite, h = hypandrium, p = paraproct, s = stylus.

Legs. Ground coloration of all legs yellowish-brown basally, deepening to dark brown apically; all tarsi deep brown, all coxae yellowish with moderately dense, white tomentum.

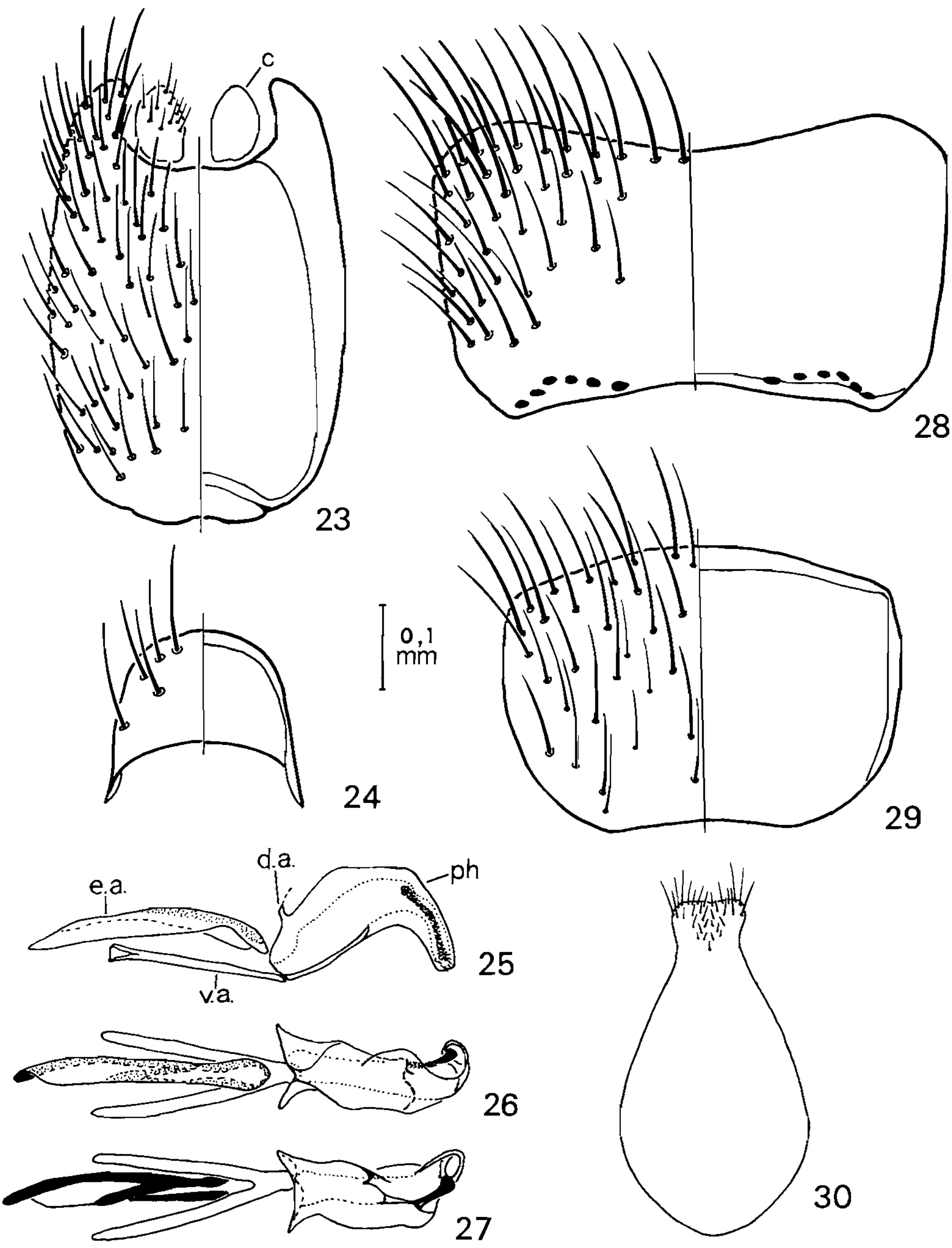
Abdomen. Ground coloration rich brown, shining; pile sparse, long at base of abdomen, tapering to shorter at apex; blond, evenly distributed over entire abdomen. Tomentum golden, extremely sparse.

Terminalia (figs 19–30). Ground coloration light brown; pile pale brown, medium lengthed. *See* generic description for further details.

Female: Similar to male holotype except as follows: length excluding antennae from 5,10 to 6,38 mm (mean of four, 5,82 mm). Ground coloration darker than male, especially legs and abdomen. Pile and tomentum sparser throughout. Head lacking pile except for a few small hairs below antennae and one or two pairs of short, black hairs on ocellar tubercle; occipital setae as in male. No tomentum on genae or frons, some on face. Length of antennal segments I/II/III (mean of four), 0,18/0,09/0,56 mm; segment III as dark brown as I and II. Proboscis about 1,4 times longer than palps, both dark brown; basal segment of palps slightly lighter brown than apical segment. Palps squat (fig. 7), basal and apical segment about equal in length. Mesonotum ground coloration darker brown with sparse golden tomentum becoming denser dorsally; one notopleural seta per side; pleura much as male, columnar pile on pleurotergite shorter, dark brown. Wings reduced brachypterous (fig. 14), coloration darker brown mainly due to concentration of macrotrichia; vein M_3 reduced to slight projection below 1st M_2 cell (**3933**). Haltere knob and stem light brown. All legs similarly coloured, darker than male, basally light brown deepening to dark brown on tibiae and tarsi. Abdomen very dark brown and very large; widest and deepest at centre of segment two; somewhat flattened. Spines of sternite eight projecting outwards more than upwards (fig. 2 vs. 3), usually two rows, the upper one containing twelve or thirteen very thick spines, the lower one containing about nine thinner, shorter spines; these rows merging into long spine-like pile below. Furca (= vaginal apodeme) as figured (fig. 31 fur.). Tergites 8, 9, 10 as shown (fig. 31); all female terminalia of a dark brown coloration with dark setae and pile.

Variation: Overall length of males excluding antennae 5,50 to 5,95 mm (mean of three 5,68 mm), of females, given above. All specimens studied of *L. ammodyta* (3 males, 4 females) were reared from larvae at two localities, Hondeklipbaai and Papendorp. Males of Papendorp population have vein M_3 entire and meeting Cu before the wing margin, single male from Hondeklipbaai population (holotype) has vein M_3 missing; females from both localities have M_3 abbreviated, greatly in most cases (**3933, 3935, 3939**) and slightly in one case (**3936**, fig. 14). All specimens except right side of holotype with one notopleural seta per side; females of Papendorp population tend to have darker legs—the femora as well as tibiae and tarsi are dark brown—than the Hondeklipbaai population. This is not evident in the males. For slight to great differences in the numerical characters *see* **3934, 3937, 3938** ♂♂ and **3933, 3935, 3936, 3939** ♀♀ in table 1. Mean length of three male antennal segments I/II/III (including holotype), 0,25/0,09/1,02 mm. Male terminalia very similar from both populations.

Material examined: 3 ♂♂, 4 ♀♀; ♂ holotype (**3934**) and 2 ♀♀ paratypes (**3933, 3939**) from SOUTH AFRICA, western Cape Province, Hondeklipbaai (30° 18′ S, 170° 16′ E), 5 to 15 m



Figs 23–30. Male terminalia of *Lyneborgia ammodyta* gen. et sp. nov. (**3934**). (23) Epandrium, (left) dorsal, (right) ventral views. (24) Hypandrium (= sternite 9), (left) dorsal, (right) ventral views. (25) Aedeagus, right lateral view. (26) Aedagus, dorsal view. (27) Aedeagus, ventral view. (28) Tergite 8 (left) dorsal, (right) ventral views. (29) Sternite 8, (left) ventral, (right) dorsal views. (30) Paraproct, dorsal view. c = cercus, d.a. = dorsal apodeme, e.a. = ejaculatory apodeme, ph = phallus, v.a. = ventral apodeme.

altitude (label reads 'sea level'), 8 Sept. 1972, M. E. and B. J. Irwin, coastal dune association; 2 ♂♂ paratypes (**3937, 3938**) and 2 ♀♀ paratypes (**3935, 3936**) from SOUTH AFRICA, western Cape Province, Papendorp, at the mouth of the Olifants River (31° 42′ S, 18° 12′ E), 5 to 15 m altitude (label reads 'sea level'), 11 Sept. 1972, M. E. Irwin, coastal dune association.

All specimens were collected as larvae and reared to adults in the laboratory.

The material is being deposited with the following institutions and persons:

Natal Museum, Pietermaritzburg **3934** (type no 1703), **3936**, **3939**.

Universitetets Zoologiske Museum, Copenhagen: **3935**, **3938**.

M. E. Irwin Collection: **3933**, **3937**.

All specimens are mounted on insect pins except for number **3939** which was initially preserved in Kahle's fluid and has since been transferred to 75% ethanol.

Notes

Larvae of *L. ammodyta* were sieved from loose coastal dune sand under and around large shrubs at Papendorp on the mouth of the Olifants River (fig. 4), and at the coastal dunes of Hondeklipbaai, western Cape Province. These shrubs were within the whitish coastal dune system and range from about 5 m to 15 m altitude above sea-level. *L. ammodyta* probably occurs at many points along the 200 km coastline that separates the two collecting sites. No specimens were sieved from coastal dunes at Port Nolloth to the north of Hondeklipbaai, and similarly no specimens were sieved from several sites from Lambert's Bay southward even though these localities were sampled more thoroughly. Neither were specimens of this species collected away from the immediate coastal dune environment even though therevid larvae were sieved from the same localities but just inland of the dunes.

Although adult specimens of *L. ammodyta* were not observed in their natural environment, they were observed in the laboratory. A few behavioural patterns are notable:

Stance. The stance of *L. ammodyta* was quite unlike the stances of other *Xestomyza*-group genera observed by me. Adult females were prone to perch with thorax and head raised from the substrate at an angle of 45° to the horizon and with the abdomen, especially the apical third, lying along the substrate surface. Males had a similar stance but did not rest the abdomen on the surface of the substrate.

Walk. Although all three pairs of legs were used in walking, the first pair was often used in a sensing manner and, at times, the hind legs were merely dragged over the surface of the substrate (*see* oviposition below).

Oviposition. A male specimen (**3938**) and a female specimen (**3936**) of *L. ammodyta* were placed together under a bell jar with twigs, dampened and dry dune sand. On the first day the female, being flightless, walked over the twigs and around the bottom of the arena, while the male perched high on the glass-sided bell jar. The next morning the female was ovipositing. I observed three ovipositional sequences and then, with stopwatch in hand, timed three others.

The ovipositional sequence consisted of seven successive phases: rest, walk, abdominal insertion, rear-and-jerk, egg-laying, and abdominal withdrawal.

The rest phase immediately followed the abdominal withdrawal phase and lasted from

5 to 20 seconds. Other rest periods were observed during and between the various phases of oviposition. These will be described below.

The walk phase lasted from 5 to 12 seconds. The pathway was direct, and only the fore and middle legs were used for locomotion; the hind legs were limply dragged behind. While in the walk phase the abdomen of the female arched outward and bent strongly downward at the tip so that the apex made contact with the sandy substrate.

When the female completed her walk phase, she stopped and began to insert her abdomen in the loose sand while simultaneously pulling forward with her hind legs, causing her abdomen to enter the sand more quickly. She continued inserting her abdomen until her body-line formed an angle of about 45° to the horizon, at which point her abdomen was approximately one-half to one-third inserted. This phase lasted from 12 to 38 seconds.

I have termed the next phase of the sequence the rear-and-jerk stage because of the action taken by the female. When her abdomen became inserted, she reared up so that her only solid contact with the substrate was her embedded abdomen. Her body-line formed an angle of 85 to 90° with the horizon and her short wings acted as braces against the sand to keep her from tipping over backward. At this point she gave a series of short, rapid jerks which shook the upper portion of her body violently and caused her abdomen to become completely inserted. The rear-and-jerk phase was interspersed with several short to longer rest periods and lasted, including rests, from 15 to 35 seconds.

The egg-laying phase was barely detectable and lasted at the most two seconds. After

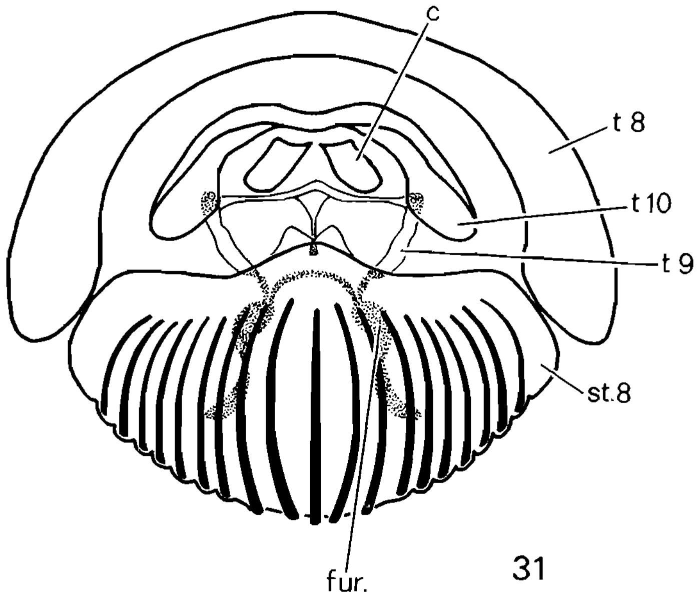


Fig. 31. Female terminalia of *Lyneborgia ammodyta* gen. et sp. nov. (3936) dorsal view, c = cercus, fur = furca or vaginal apodeme, st. 8 = sternite 8, t.8 = tergite 8, t.9 = tergite 9, t.10 = tergite 10.

egg-deposition a further rest period ensued, after which the female slowly withdrew her abdomen from the sand. This phase of the sequence lasted from 10 to 45 seconds.

It was noted that the frequency and duration of rest periods increased with the number of consecutive eggs laid. Individual ovipositional sequences lasted from 60 to 130 seconds.

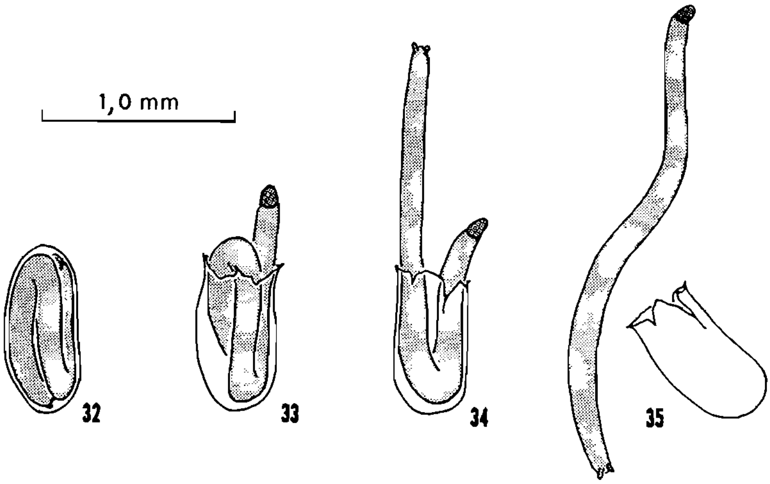
The female (3936) laid a total of 27 eggs, most of which hatched, indicating that she had mated.

Flight: Males of *L. ammodyta* were slow, fluttery fliers. The rounded, wide wings (fig. 13) support the observation of fluttery flight from the morphological viewpoint. To my knowledge all other therevids fly fast and straight for short distances. A possible explanation for the flutter-flight lies in the fact that the flightless females spend most of their lives on or about stems and twigs of small shrubs; males seeking out females need a slower, more manoeuvrable flight pattern under these conditions.

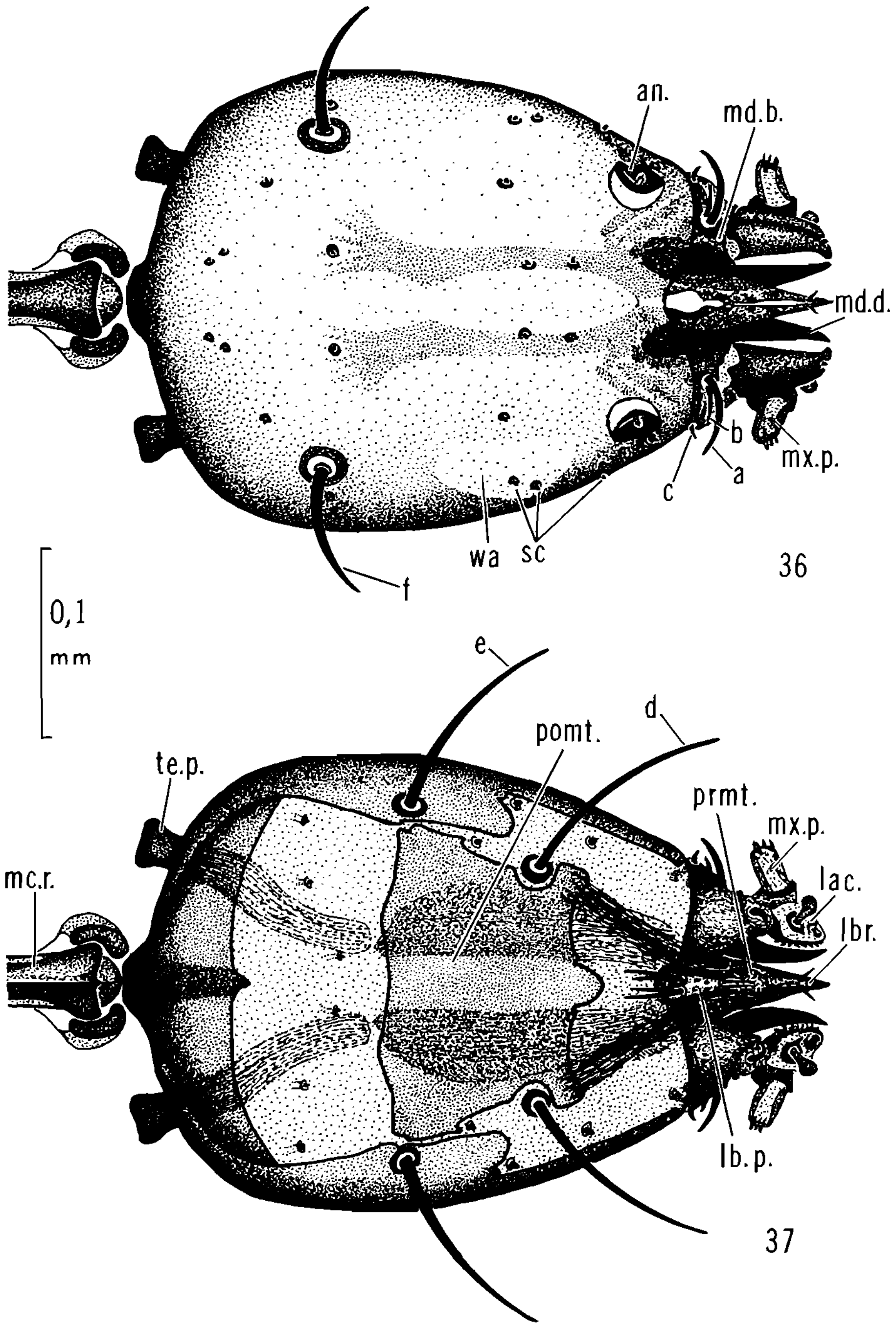
Hatching sequence. Although the hatching sequence was not directly observed, eggs immersed in Kahle's fluid preserved several of the various stages involved, and with these it was possible to piece together most of the steps of the sequence.

Prior to hatching, the developed embryo was bent in thirds within the egg chorion. The head end was pointed towards the anterior edge of the egg; the body looped one and a half times within the chorion; the posterior portion of the abdomen pointed towards the posterior edge of the egg (fig. 32). Upon hatching, the larva forced its head through the chorion layer at the anterior margin of the egg. At the same time, or shortly thereafter, the looped-over portion lying next to the head pushed through the anterior chorion layer (fig. 33). The freed, anterior, looped-over portion of the body continued to uncoil until the posterior end of the abdomen was free, extending anteriorly past the head (fig. 34). The larva then emerged from the egg chorion completely (fig. 35).

The hatching sequence of *L. ammodyta* was quite similar to that of members of the



Figs 32–35. Hatching sequence of *Lyneborgia ammodyta* gen. et sp. nov. (32) First instar larva within egg just prior to hatching. (33) First instar larva bursting egg chorion. (34) First instar larva emerging from egg chorion. (35) Fully emerged first instar larva with burst, empty egg chorion.



Figs 36–37. Last instar larval head capsule of *Lyneborgia ammodyta* gen. et sp. nov., ♀, (3939). (36) Dorsal view. (37) Ventral view. a = mandibular seta; an = antenna; b = mandibular seta; c = mandibular seta; d = cephalic seta; e = cephalic seta; f = cephalic seta; lac. = lacinia; lb.p. = labial palp; lbr. = labrum; mc.r. = metacephalic rod; md.b. = basal segment of mandible; md.d. = distal segment of mandible; mx.p. = maxillar palp; pomt. = postmentum; prmt. = prementum; sc = sensory cell; te.p. = posterior arm of tentorium; wa = white area.

pherocerine sector of the *Rueppellia*-group, the only other section of the Therevidae where the hatching sequence is known. It did, however, differ in one major respect: prior to hatching the pherocerine embryo was bent into fourths, not thirds, so that the body made two complete loops, not one and a half, within the egg chorion.

Lyneborgia stenoptera sp. nov.

Derivation of name: στενόζ = narrow; πτερόν = wing.

Diagnosis: This species is represented by a single female, the holotype. This can be separated from the female of *L. ammodyta* by the following combination of characters: very large body size, measuring more than 9 mm in length; wings, measured from humeral cross-vein to apex, less than 1 mm long, stenopterous; halteres very reduced, measuring less than 0,5 mm in length. Legs with a uniform medium brown ground coloration. Sternite eight with stout spines directed more upward than outwards (fig. 3 vs. 2).

Description

Female, holotype, fig. 3. *See* **3932** in table 1 for measurements and numerical characters.

Length, excluding antennae, 9,30 mm. Ground coloration of head and mesonotum dark brown, rest medium brown. Pile sparse, fairly short on head and thorax, slightly longer on abdomen; dark brown.

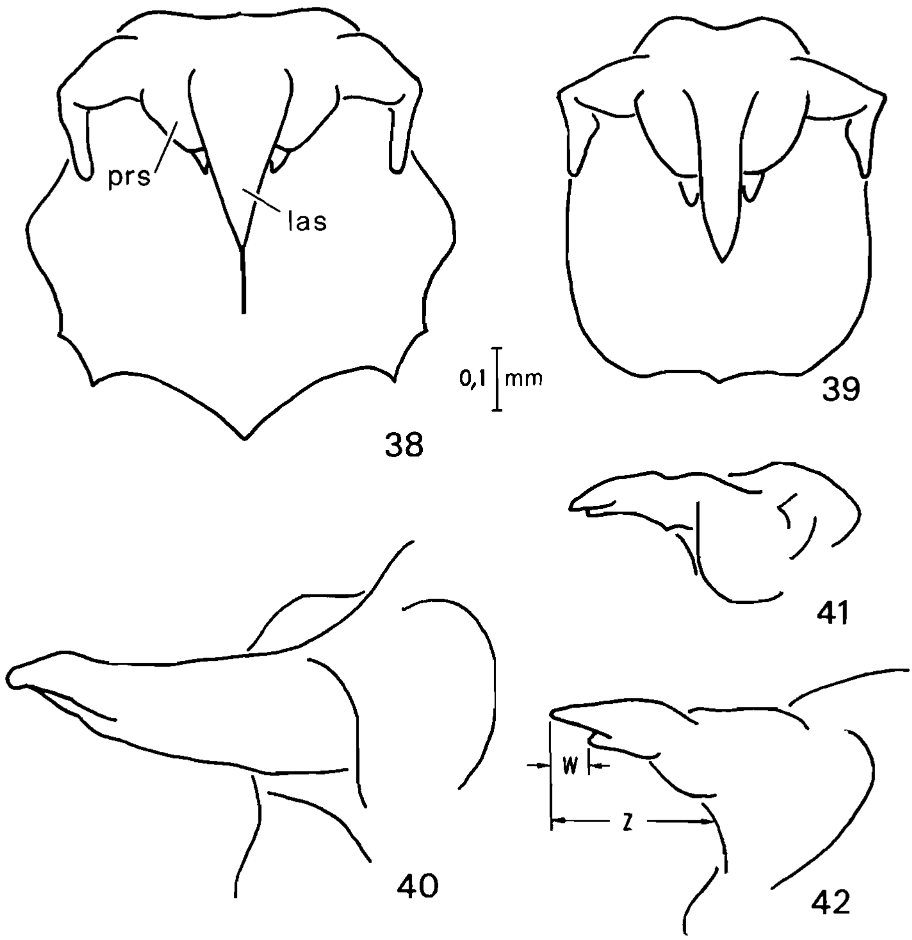
Head. Ground coloration very dark brown, almost black. Pile restricted to short, sparse hairs laterad and ventrad of antennal sockets. Tomentum lacking on frons; sparse, golden on face; denser, golden on genae. No hairs on ocellar tubercle; occipital setae stout, black scattered, about 19 pairs. Proboscis only slightly longer than palps, both much longer than those of *L. ammodyta*. Palps thinly setose, elongate (fig. 8), apical segment darker brown than basal segment; both about equal in length, basal segment about $\frac{3}{4}$ as wide as apical segment. Length of antennal segments I/II/III, 0,18/0, 08/0,60 mm; segments I and II dark brown, III light brown. Antennal pile and tomentum as in female *L. ammodyta*; segment III as in fig. 12.

Thorax. Ground coloration of mesonotum and scutellum dark brown; pleural areas medium brown. Pile on mesonotum thin, dark; scutellum bare. Pleural area bare of pile except for pleurotergite which has a single central column of 4–6 elongate, dark hairs. Dense white tomentum on sternopleurite, meropleurite, episternum and epimeron; golden tomentum on mesonotum and scutellum. Mesonotum with one notopleural seta on each side.

Wings. Greatly reduced, stenopterous (fig. 15). Ground coloration very dark due to concentration of macrotrichia; radial sector and basal portion of medial sector distinguishable; veins beyond basal third faint or indistinguishable. Halteres greatly reduced (*see* graph, page 534).

Legs. Ground coloration of all coxae and legs uniformly medium brown. Coxae with dense whitish tomentum.

Abdomen. Ground coloration medium brown; pile brown of medium density dorsally on each of tergites and ventrally on each of the sternites, increasing in length towards the apex. Tomentum very sparse, light brown. Abdomen large, widest and deepest at centre of segment two.

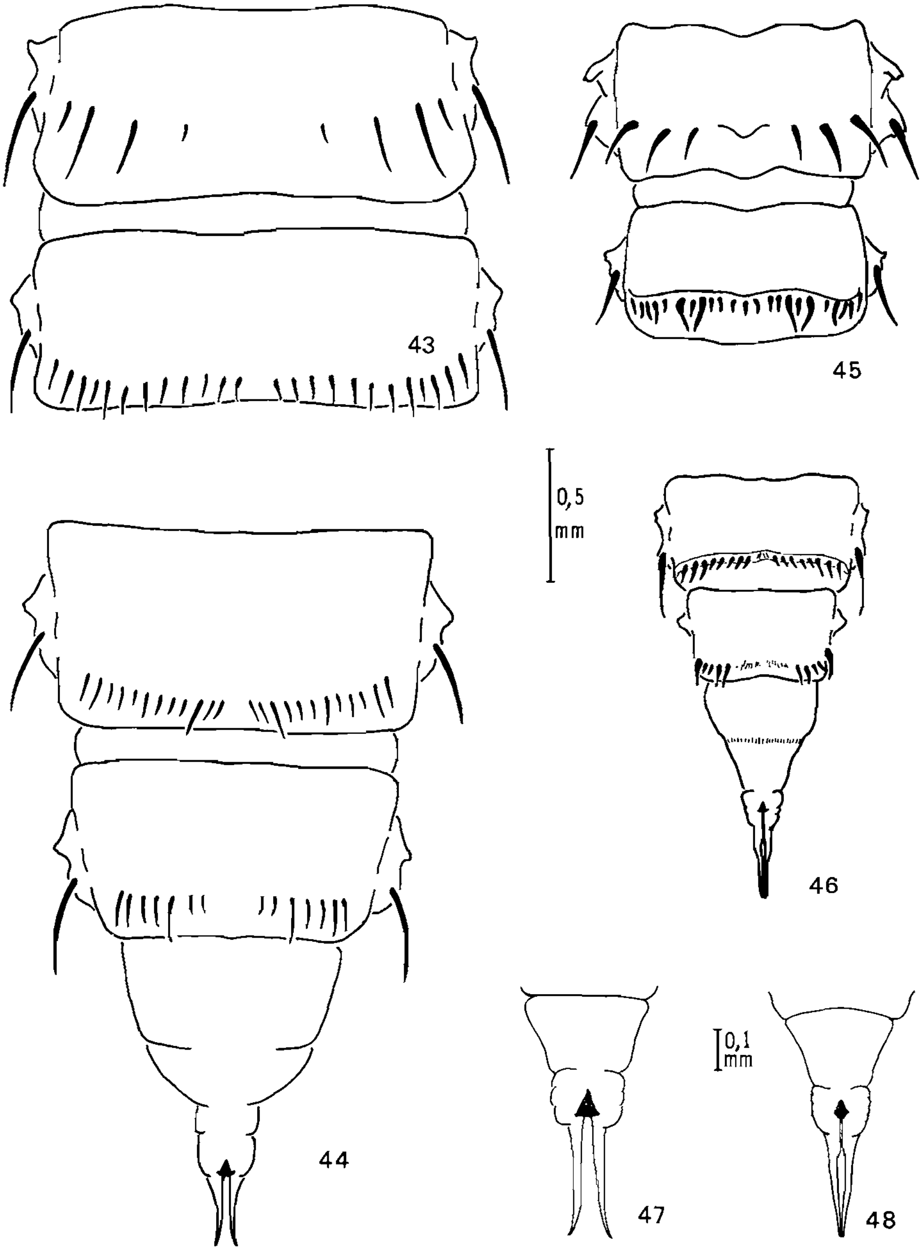


Figs. 38–42. Pupae of *Lyneborgia* gen. nov. (38) Labral and proboscial sheaths of *stenoptera* sp. nov., ♀, (**3932**), ventral view. (39) Labial and proboscial sheaths of *ammodyta* sp. nov., ♀, (**3939**), ventral view. (40) Antennal sheath of *ammodyta* sp. nov., ♂, (**3934**), ventrolateral view. (41) Antennal sheath of *ammodyta* sp. nov., ♀, (**3939**), ventral view. (42) Antennal sheath of *stenoptera* sp. nov., ♀, (**3932**), ventral view. las = labral sheath; prs = proboscial sheath.

Terminalia. Much like that of female *L. ammodyta* (*see* fig. 31). Spines on sternite eight black, directed more upwards than outwards, in two rows, the upper one consisting of ten very stout, the lower one of nine thinner, shorter spines; these rows of spines tend to merge with long spine-like pile below.

Material examined: 1 ♀ holotype (**3932**), SOUTH AFRICA, western Cape Province, 17 km NNE Hondeklipbaai (30° 10′ S, 17° 20′ E), 60 m altitude, 8 Sept. 1972, M. E. and B. J. Irwin; reddish sand association.

The single specimen is deposited in the Natal Museum, Pietermaritzburg (type no. 1704). It was initially preserved in Kahle's fluid and has since been transferred to 75% ethanol. It was collected as a pupa.



Figs 43–48. Pupae of *Lyneborgia* gen. nov. (43) Abdominal segments 1–2 of *stenoptera* sp. nov., ♀, (3932), dorsal view. (44) Abdominal segments 7–9 of *stenoptera* sp. nov., ♀, (3932), dorsal view. (45) Abdominal segments 1–2 of *ammodyta* sp. nov., ♂, (3934), dorsal view. (46) Abdominal segments 7–9 of *ammodyta* sp. nov., ♂, (3934), dorsal view. (47) Caudal spines of *stenoptera* sp. nov., ♀, (3932), dorsal view. (48) Caudal spines of *ammodyta* sp. nov., ♂, (3934), dorsal view.

Notes:

The single pupa of *L. stenoptera* was collected from under a dense, squat shrub, at an elevation of about 60 metres, 17 km NNE of Hondeklipbaai. The landscape was dotted with similar shrubs and succulent plants (fig. 5). A loose, rusty-coloured sand substrate formed small dunes next to the perennial shrubs.

The only specimen of *L. stenoptera* emerged from the pupal case in the field. I observed her for a few minutes on each of two days, after which she was preserved in Kahle's fluid. These few observations were made while the specimen was walking around in a small glass vial.

Stance. Like *L. ammodyta*, the female *L. stenoptera* (**3932**) stood at a high angle, her head, thorax and antennae projecting at an angle of about 50° to the horizon. Her forelegs were well forward, her middle legs straight out and her hind legs slightly hindward. Her abdomen curled slightly upward and doubled over itself much like young nymphs of some species of mantids.

Walk. Her walk was jerky, using all legs, but she occasionally used her forelegs as sensors somewhat like females of *L. ammodyta.*

ACKNOWLEDGEMENTS

The following people and institutes are gratefully acknowledged for their assistance in the preparation of this manuscript: Dr B. R. Stuckenberg, Natal Museum, for encouragement, critical comments and suggestions; Dr Leif Lyneborg, University Zoological Museum, Copenhagen, for critical comments and revised terminology of larval cranial morphology; Mr J. B. McCormack, Town and Regional Planning, Natal Provincial Administration, Pietermaritzburg, for statistical tests; and my wife Bonnie, for patiently weathering the varied climate of the Western Cape and assisting in the collection of these and other flies.

EXPLANATION OF CHARACTER NUMBERS

Ch. 1: Width of head
Ch. 2: Distance between eyes at vertex
Ch. 3: Width between outer margins of upper ocelli
Ch. 4: Frontal width at anterior ocellus
Ch. 5: Frontal width at level of antennae
Ch. 6: Facial width at lower edge of eye
Ch. 9: Height of head
Ch. 10: Height of eye
Ch. 12: Genal width
Ch. 13: Depth of head
Ch. 14: Depth of eye
Ch. 15: Frontal protuberance
Ch. 16: Ratio of antennal insertion (a/b; a+b = ch. 9)
Ch. 17: Length of proboscis
Ch. 18: Length of maxillary palp
Ch. 19: Length of first antennal segment
Ch. 20: Width of first antennal segment
Ch. 21: Length of second antennal segment
Ch. 22: Width of second antennal segment
Ch. 23: Length of third antennal segment
Ch. 24: Width of third antennal segment
Ch. 26: Length of mesonotum (excl. of scutellum)
Ch. 27: Width of mesonotum (between notopleural setae)
Ch. 32: Haltere length (stem/knob)
Ch. 33: Length of mesonotal pile
Ch. 34: Length of wing (from humeral cross-vein to apex)
Ch. 35: Width of wing
Ch. 36: Length of vein R_4 (from fork)
Ch. 37: Length of vein R_5 (from fork)
Ch. 38: Distance between apex of veins R_4 and R_5
Ch. 46: Length of front tibia
Ch. 47: Width of front tibia
Ch. 48: Length of hind tibia
Ch. 50: Length of front basitarsus
Ch. 51: Length of hind basitarsus
Ch. 55: Length of longest pd seta of t1.
Ch. 56: Width of abdomen at centre of segment 2
Ch. 57: Width of abdomen at centre of segment 6
Ch. 58: Height of abdomen at centre of segment 2

SPECIMENS

Character Numbers	*ammodyta* ♂ 3934	*ammodyta* ♂ 3937	*ammodyta* ♂ 3938	*ammodyta* ♀ 3933	*ammodyta* ♀ 3935	*ammodyta* ♀ 3936	*ammodyta* ♀ 3939	*stenoptera* ♀ 3932
1	0,90	0,93	0,95	0,85	0,95	0,85	0,83	1,03
2	0,38	0,43	0,45	0,35	0,40	0,38	0,38	0,48
3	0,23	0,23	0,23	0,20	0,18	0,15	0,20	0,20
4	0,38	0,38	0,43	0,33	0,33	0,33	0,33	0,48
5	0,38	0,38	0,40	0,35	0,38	0,35	0,40	0,50
6	0,40	0,38	0,40	0,48	0,40	0,38	0,48	0,48
9	0,65	0,65	0,73	0,65	0,68	0,60	0,65	0,75
10	0,53	0,53	0,55	0,50	0,55	0,53	0,48	0,58
12	0,10	0,03	0,05	0,08	0,05	0,05	0,10	0,13
13	0,63	0,55	6,68	0,60	0,63	0,57	0,55	0,68
14	0,45	0,45	0,48	0,38	0,45	0,43	0,40	0,43
15	0,10	0,08	0,10	0,08	0,10	0,08	0,10	0,10
16	0,20/ 0,35	0,25/ 0,40	0,30/ 0,43	0,23/ 0,43	0,25/ 0,43	0,25/ 0,35	0,25/ 0,40	0,23/ 0,53
17	0,43	0,38	0,50	0,40	0,45	0,33	0,38	0,43
18	0,33	0,33	0,38	0,28	0,28	0,28	0,28	0,45
19	0,25	0,25	0,25	0,18	0,20	0,15	0,18	0,18
20	0,10	0,08	0,10	0,08	0,10	0,08	0,08	0,08
21	0,10	0,08	0,10	0,08	0,08	0,08	0,10	0,08
22	0,13	0,10	0,13	0,08	0,10	0,10	0,10	0,10
23	0,98	0,95	1,13	0,58	0,58	0,53	0,53	0,60
24	0,23	0,23	0,23	0,15	0,15	0,15	0,10	0,13
26	1,00	1,00	1,10	0,78	0,85	0,75	0,80	0,88
27	0,73	0,73	0,83	0,70	0,75	0,63	0,65	0,80
32	0,58/ 0,43	0,55/ 0,43	0,60/ 0,45	0,28/ 0,40	0,28/ 0,40	0,28/ 0,43	0,25/ 0,43	0,05/ 0,30
33	0,08	0,10	0,13	0,05	0,05	0,05	0,08	0,08
34	4,00	4,55	4,43	2,60	2,55	2,50	2,75	0,85
35	1,68	1,83	1,93	0,88	0,88	0,75	0,95	0,28
36	1,13	1,43	1,35	0,68	0,60	0,60	0,63	0,15
37	1,23	1,50	1,40	0,70	0,63	0,65	0,68	0,15
38	0,33	0,40	0,43	0,23	0,18	0,20	0,18	0,03
46	1,55	1,53	1,75	1,40	1,60	1,23	1,05	1,75
47	0,10	0,10	0,13	0,13	0,13	0,13	0,10	0,13
48	2,25	2,23	2,33	2,13	2,45	2,03	1,95	2,68
50	0,95	0,98	1,00	0,85	0,95	0,83	0,53	1,00
51	0.93	1,00	1,03	0,90	1,13	0,98	0,75	1,18
55	0,10	0,10	0,10	—	0,10	0,10	0,08	0,10
56	0,38	0,60	0,60	1,10	1,13	0,80	1,13	1,48
57	0,43	0,43	0,43	0,65	0,93	0,83	0,78	1,03
58	0,63	0,63	0,65	0,78	0,88	0,88	1,03	1,35

Table 1. Measurements (in mm) of specimens of *Lyneborgia* gen. nov.
3934 is the holotype of *L. ammodyta* sp. nov.
3932 is the holotype of *L. stenoptera* sp. nov.

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Date received: 18 January 1973